THIRD
ANNUAL
INVENTORY REPORT
ON
MAINE'S FORESTS

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September 25, 2002

Printed under Appropriation No. 010 04A 6663 022

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Third Annual Inventory Report on Maine's Forests

Synopsis

The third annual inventory report continues to reinforce an improved inventory situation from that of just six years ago.

That significant improvement provides additional flexibility and time to address how we utilize existing mature forest resources, while anticipating a major flush of Ingrowth: young, vigorous, and newly merchantable trees, within the next 10 years.

The flush of young trees that will come into measurement size soon (5-10 years) is particularly evident in the eastern and northern regions, where some preliminary analysis suggests that the balsam fir ingrowth component exceeds its accretion estimate.

Timberland acreage is also stable; land use conversions in southern Maine are more than offset by agricultural reversions to forestland across the remainder of the state.

Inventory remains relatively stable, declining just 1% over the last three years. While the Maine Forest Service expects this small rate of decline to continue for the next five years, we also expect an increase in inventory in five to 10 years due to the ingrowth of young, vigorous trees into measurable size classes.

Department of Conservation
Maine Forest Service
Forest Health & Monitoring Division

USDA Forest Service
Forest Inventory & Analysis
Northeastern Research Station

Third Annual Inventory Report on Maine's Forests

Executive Summary

The USDA Forest Service, in partnership with the Department of Conservation's Maine Forest Service, began a new annual forest inventory in 1999. The new inventory system measures a 20% statewide sample of Maine's forests every year. This third interim annual report is based on data collected from 683 plots in Panel #1, 688 plots in Panel #2, and 666 plots in 2001's Panel #3. The combined data of 1999, 2000, and 2001 provide a limited snapshot of estimates of forestland area and inventory. For the first time, estimates of change are being provided on a very limited basis. The combined 3 years of data ***is*** strong enough to provide the following estimates:

- Significant increases in the statewide stocking of sapling trees in all the dbh classes (1", 2", 3", and 4"), and in the species groups of balsam fir, spruces, and red maple. The majority of these increases are located in the Northern Region (Appendix A. Table 16A. And Table 16-A2).

- In 2001, Maine's forests had an estimated inventory of 279 million cords of merchantable wood (pulpwood quality or better); this is a significant increase (+10%) from the 1995 inventory estimate of 254 million cords (Appendix C. Figure 2.).

- Current pulpwood quality or better volume is estimated at an average of 16.0 cords per acre. This is a 1.0 cord per acre increase from the 1995 estimate (Appendix C. Figure 1.).

- Significant changes, an increase of 1.9 million acres in the Nonindustrial Private Ownership Class and a corresponding 1.6 million acre decrease in the Forest Industry Ownership Class (Appendix A. Table 2.).

- 87% of the timberland area is in desirable stocking classes (moderately stocked and fully stocked), essentially unchanged from the 1995 estimate. (Appendix A. Table 10.).

- Maine remains 90% forested and 97% of the forestland are productive timberland (Appendix A. Table 1.).

THIRD ANNUAL INVENTORY REPORT
ON
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INTRODUCTION

The USDA Forest Service - Forest Inventory & Analysis, Northeastern Research Station has been the major source of state level forest inventory information for Maine. This program provides periodic information on a variety of parameters describing forests and forest use: area and type of forest; species, size, and health of trees; and rates of tree growth, mortality, and removals.

The USDA Forest Service conducted four forest inventories in Maine (1954 - 1958, 1968 - 1970, 1980 - 1982, and 1994 - 1996). These efforts have been augmented by additional inventory efforts to address specific issues. Despite this level of monitoring, Maine has faced contentious debates concerning sustainable forest management over the past decade. Until the publication of new forest inventory information in 1996, the most current inventory data was collected in 1980 - 1982. The long period between inventories had not served Maine's policy discussions well and had contributed to a high degree of uncertainty about the state of the forest resource.

In response to customer needs, the USDA Forest Service - Forest Inventory & Analysis has a new Congressional mandate (Public Law 105-185, The Agricultural Research, Extension, and Education Reform Act of 1998) to change the way they conduct forest inventories nationwide, including:

1) Change from a periodic to an annual forest inventory which measures 20% of all inventory plots in each state each year;
2) Development of consistency in the program across all forest lands;
3) Produce complete state reports at five-year intervals.

The 118th Maine Legislature authorized the Maine Forest Service to participate with the USDA Forest Service to implement an annual forest inventory (PL 1997 C.720). Maine was the first state in the Northeast to participate in this new inventory process and was the first state in the nation to convert to the new national core variables. The annual inventory measures 20% of the inventory plots every year. When the 1999 plots are again revisited and completely remeasured in the sixth inventory year (2004), Maine will begin the process of a continuous annual inventory system utilizing the most recent five years of inventory data for estimation purposes.

Fieldwork under the inventory system began in April 1999 and will be completed over a five-year period. Plots are located systematically across the state on all types of ownerships. As required by law, landowners are contacted for

permission to access the plots. The USDA Forest Service - Forest Inventory and Analysis Unit maintains the list of exact plot locations. The plot location data is not released to any other group or individual.

The October 24, 2000 "Report Of The 1999 Annual Inventory of Maine's Forests" utilized an original Panel #1 sample of 646 plots. Concurrent to that data analysis and reporting, field crews were measuring an additional 37 plots during the 2000 measurement season. This additional sample is now assigned to Panel #1. The 1999 Panel #1 sample now totals 683 plots, 688 plots comprise the 2000 Panel #2 sample, and 666 plots comprise the 2001 Panel #3 sample.

The Maine Forest Service, with the cooperation and full support of the USDA Forest Service, produces a more enhanced interim annual report. This third annual report provides estimates of forest area; species, number, and size of trees; and volume based on the combined data collected in 1999, 2000, and 2001. It also contains for the first time several regional assessments of inventory, and a component of change estimate. It also contains a results and discussion section that extends far beyond what the USDA Forest Service intended to issue as a core interim annual report for individual states.

The annual inventory system is structured to aggregate all previous panel datasets into a single moving average and representation. The goal after 2003 is to continue to aggregate into a moving average the most current 5-year's of data. The only reason to intensively examine a single year's worth of data would be to understand the immediate impact of a recent catastrophic event, i.e. 1938 Hurricane, 1998 Ice Storm, Hemlock Woolly Adelgid.

There are three major enhancements in the estimation and analytical process of producing this 3rd Annual Report:

- Each of the 2,037 plots that comprise the current data was stratified using satellite imagery. Prior to this report, every plot in the same county was assigned the same acreage expansion factor based on the 1990 Census estimate of total land area in the county. The stratification process assigned each plot to one of six strata; based on the interpreted proportions of forested/nonforest land uses surrounding the plot's location and footprint. The use of strata to weight acreage expansion factors generally improves the estimation of the mean and more greatly reduces the 95% confidence interval around that mean estimate.

- This report provides a limited and enhanced set of estimates within 4 regions. The regions are aggregations of existing FIA Units, the smallest area on which past estimates have been normally based. The regions were chosen for their similarity in forest types, management, and climatic conditions and are as follows:

- Eastern Region – Hancock, Penobscot, and Washington Counties, all are separate FIA units,
- Northern Region – Aroostook, Piscataquis, and Somerset Counties, all are separate FIA units,
- Southern Region – Capital Region FIA unit (Kennebec, Knox, Lincoln, and Waldo Counties) and the Casco Bay Region FIA unit (Androscoggin, Cumberland, Sagadahoc, and York Counties), and
- Western Region – Western FIA unit (Oxford and Franklin Counties).

- This report contains the first published estimate of components of change since the 1995 periodic inventory.

LIMITATIONS OF COMBINED DATASET

The annual inventory is designed to measure 20% (one-fifth) of the inventory plots every year. Estimates of forest characteristics can be derived from each annual measurement; however, the relatively small annual sample, by itself, yields estimates with lower precision than an inventory that measures all plots in a short period (the periodic inventory). Until the full five-year cycle is completed, the annual inventory may yield information that although is statistically valid, may fluctuate from year to year and cause concern or lack of confidence in some users. (1998, A. Gillespie. "Pros and Cons of Continuous Forest Inventory: Customer Perspectives." Presented at the "Integrated Tools for Natural Resources Inventories in the 21st Century" Conference, August 16-19, 1998, Boise, Idaho.)

A better approach for providing more precise estimates in the annual inventory is to use a moving average, combining the latest data with all previous years data, i.e. 2001 data with the 1999 and 2000 data. The reliability of estimates using a moving average will improve as we progress through the first five-year measurement cycle. The USDA Forest Service and the Maine Forest Service have chosen to utilize this method of aggregating datasets in their interim annual reporting of inventory results.

Data on forest area and inventory from the combined dataset are reported in the tables in Appendix A. The tables correspond with the same numbered tables in the 1995 inventory report "Forest Statistics of Maine, 1995."

The combined inventory estimates are compared to the 1995 estimates using the 95% confidence limit as a statistical test of the estimated means. The 95% confidence limit is expressed as a range around the estimate of the mean. If the ranges for the two means (1995 and 2000) do not overlap, we are 95% certain that there is a statistically significant difference in the populations that were sampled to provide the estimates of those means. These statistically significant differences are noted where they occur in each of the tables in Appendix A.

Comparisons for significant differences between the combined data and the 1995 data for some classifications (Forest Type Group, Stand Size Class, and Stocking Class) can not be made, due to changes in definitions or algorithms used by the USDA Forest Service to compile the data (See footnote in Appendix A. Table 2.). The 1995 data will not be reprocessed until a series of national level algorithms is thoroughly developed and tested.

The new algorithms that classify plots into a specific Forest type, Stand Size Class, or the 2 Stocking Classes (Growing Stock and All Live) are forthcoming and will be incorporated as soon as possible.

Due to the small sample size of the combined data and as recommended by the USDA Forest Service – Forest Inventory & Analysis Unit, county level estimates are not reported and some species level and diameter classes have been aggregated into groups.

The data for estimating components of change is introduced with this report and will be limited to a statewide estimate.

RESULTS & DISCUSSION

TIMBERLAND AREA

- **The 2001 inventory report shows that forestland area and timberland area are stable** (Appendix A. Table 1.).

  The 2001 inventory is based on a new stratification scheme that assigns an acreage expansion weight to the plot based on interpreted proportions of the forested and nonforested areas surrounding the immediate plot location and footprint. The 2000 census data has not yet been released; therefore, the total State of Maine land area remains at 19.75 million land acres as estimated in the 1990 Census.

  The major land use class of Timberland now includes Other Forestland and Urban Forestland.

  This inclusion of Other Forestland and Urban Forestland adds an estimated 82,984 acres (approximately 8 plots, <1% of the sample) to the 1999 - 2001 estimate of Timberland that are not represented in the 1995 estimate. MFS does not have the current information to restate the 1995 Inventory estimates to match the current classifications, calculated variables, and algorithms. It is our belief that these additional acres do not create a skewed representation and that the comparisons noted between the 1999 - 2001 data and the 1995 data are still valid.

- **Maple/Beech/Birch continues to be the most common forest type group, with 7.3 million acres, followed by the Spruce-Fir group with 5.2 million acres. These two groups represent 71% of all timberland acreages, nearly identical to their 1995-combined representation of 73%** (Appendix A. Table 2.)**.**

- **Since 1995, the combined data estimates significant changes in ownership classes, a 1.9 million acre increase in the Nonindustrial Private ownership class and a corresponding 1.6 million acre decrease in the Forest Industry ownership class** (Appendix A. Table 2.).

  These net changes reflect a new distribution of land ownership and management that is corroborated by a separate analysis.

  The *"2000 Silvicultural Activities Report – including Annual Report on Clearcutting"*, published May 25, 2001, by the Department of Conservation, Maine Forest Service introduced a new landowner

category, *"Institutional Investor Timberlands (f*orestlands owned by organizations that hold assets as fiduciaries for the benefit of others)." This landowner category is a subset of the broader Nonindustrial Private ownership class.

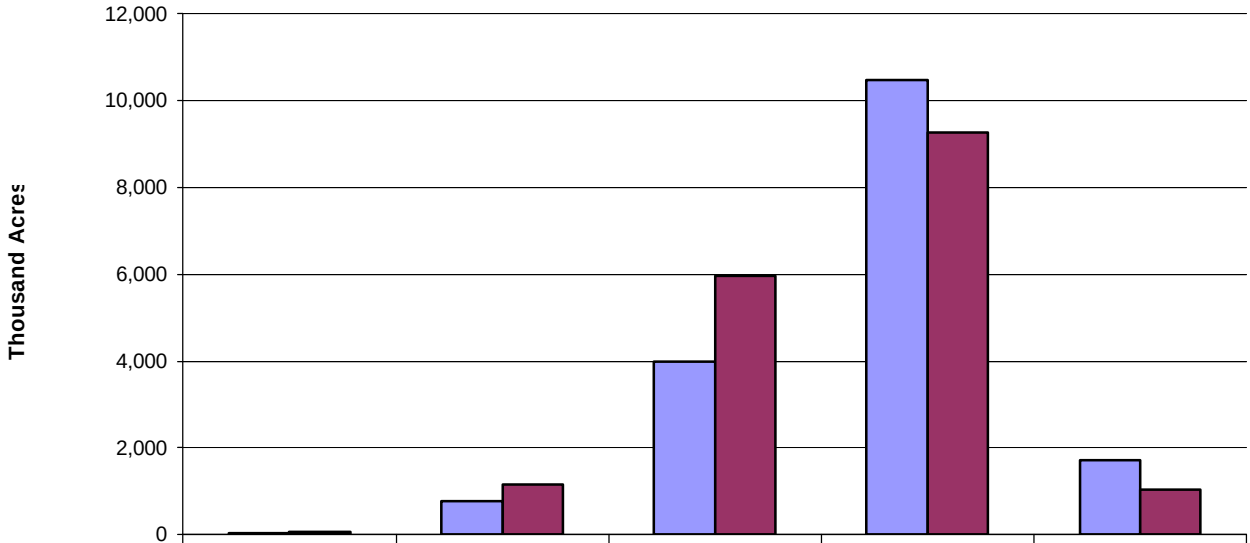
- **Timberland acres are fairly evenly distributed among the stand size classes and similar to the 1995 breakdown: Large Diameter stands represent 33%, the Medium Diameter has a 38% share, and the Small Diameter class has a 28% share of the timberland acreage** (Appendix A. Table 3.).

- **The stocking class assignment, based on just growing stock trees, depicts a general downward trend to lower stocking classes. Since 1995, the acreage of Moderately, Fully, and Overstocked Classes have declined 4%, with a corresponding increase in the Poorly and Nonstocked classes** (Appendix A. Table 4.).

- **For all live trees (1.0" dbh and larger), the stocking class assignment depicts a similar downward trend to lower stocking classes. The acreage of Fully and Overstocked classes declined by 1.9 million acres, while the acreage of Moderately stocked class increased by 2.0 million acres** (Appendix A. Table 10.).

- **In 2001, 87% of timberland acres (15.1 million acres) were in desirable stocking classes (moderately and fully stocked), a minor increase from the similar 1995 classification** (Appendix A. Table 10. And Figure 1.).

Figure 1. Distribution of Timberland area by Stocking Class of All Live Trees (1.0" Dbh and larger), 1995 and Combined 1999 - 2001



	Nonstocked	Poorly Stocked	Moderately Stocked	Fully Stocked	Overstocked
1995	18.4	762.9	3974.7	10481.1	1715.0
1999 - 2001	61.8	1142.0	5951.7	9266.2	1027.1

- The 3 years of data now estimate a significant increase of 0.9 million acres in the 50 – 99 square feet per acre basal area class (Appendix A. Table 12.).

MFS conducted an additional analysis to examine, what, if any, patterns could be found in the distribution of stocking class and stand size class among the current landowner classes for the 0-49 sq. ft./acre basal area class.

- There are an estimated 3.1 million acres in the 0 – 49 sq. ft. basal area class (Appendix A. Table 12. And Table 1.).
  - 25% of these acres (0.8 million acres) are classified into the nonstocked or poorly stocked classes.
  - The Non-industrial Private owner class currently accounts for 70% of these acres.

Table 1. Percentage of Timberland acres in the 0 - 49 sq. ft. basal area class – by ownership class, stand size class, and stocking class, (Basal Area is based on All Live trees tallied 1.0" dbh and larger), Maine, 1999-2001 data

	Ownership Class			
Stand Size Class and Stocking Class	Public	Forest Industry	Nonindustrial Private	Subtotal of Stocking Class
Nonstocked Stands				
Nonstocked & Poorly Stocked	0.08%	0.16%	1.77%	2.01% [3]
Moderately Stocked	0.00%	0.00%	0.00%	0.00%
Fully Stocked & Overstocked	0.00%	0.00%	0.00%	0.00%
Subtotal of Nonstocked Stands	0.08%	0.16%	1.77%	2.01%
Owner Class Share of Stand Size Class	4.15%	8.13%	87.72%	
Small Diameter Stands				
Nonstocked & Poorly Stocked	0.16%	1.98%	5.50%	7.64%
Moderately Stocked	0.16%	9.17%	18.10%	27.44% [1]
Fully Stocked & Overstocked	1.01%	22.03%	22.09%	45.13%
Subtotal of Small Diameter Stands	1.33%	33.19%	45.69%	80.21%
Owner Class Share of Stand Size Class	1.66%	41.38%	56.97%	
Medium Diameter Stands				
Nonstocked & Poorly Stocked	1.09%	3.12%	7.51%	11.72%
Moderately Stocked	0.08%	0.67%	0.47%	1.22%
Fully Stocked & Overstocked	0.00%	0.04%	0.51%	0.55%
Subtotal of Medium Diameter Stands	1.17%	3.82%	8.48%	13.48%
Owner Class Share of Stand Size Class	8.70%	28.37%	62.93%	
Large Diameter Stands				
Nonstocked & Poorly Stocked	0.00%	0.69%	2.58%	3.26% [3]
Moderately Stocked	0.04%	0.66%	0.16%	0.86%
Fully Stocked & Overstocked	0.00%	0.06%	0.12%	0.18%
Subtotal of Large Diameter Stands	0.04%	1.41%	2.85%	4.30%
Owner Class Share of Stand Size Class	0.98%	32.71%	66.31%	
Ownership share of 0 - 49 sq. ft. basal area class	2.63%	38.58% [2]	58.79%	100.00%
Ownership share of 17.45 million Timberland Acres	5%	33%	63%	

[1] 73% of all acres in the 0 - 49 sq. ft. basal area class are in the Small Diameter Stand Size Class and are in desirable stocking classes (moderately stocked, fully stocked, or overstocked)

[2] When compared to its proportional share of All Timberland acres, the Forest Industry ownership class has substantially more of this basal area class than the Public or Nonindustrial owners. The management of these low basal area stands will play an important role in the development of Maine's future forests.

[3] 5.3% of the acres in the 0 - 49 sq. ft. basal area class occur in the stand size class of either Nonstocked or Large Diameter and have a undesirable Nonstocked or Poorly Stocked stocking class, 83% of the acreage in these undesirable categories occurs on Nonindustrial Private ownerships.

Table 1A reconfigures the data for the 0 – 49 sq. ft. basal area class to present a regional perspective on the distribution of timberland acres by stand size class and stocking class.

- The Northern Region (Aroostook, Piscataquis, and Somerset Counties) has more than its fair share of the acreage in the 0– 49 sq. ft. basal area class, the region's 1.71 Million acres comprise 56% of the total.
- The Southern Region (Androscoggin, Cumberland, Kennebec, Knox, Lincoln, Sagadahoc, Waldo, and York Counties) has an over-representation of acreage in the Nonstocked & Poorly Stocked category. The 116,565 acres represent 37% of the region's total acreage in this basal area class.
- This same over-representation in the Nonstocked & Poorly Stocked Category also occurs in the Western Region (Franklin and Oxford Counties) with 113,933 acres or 43% of its region's acres in this basal area class.

Table 1A: Timberland acres in the 0 - 49 sq. ft. basal area class by region, stand size class, and stocking class based on All Live Trees tallied, Maine, 1999-2001 data

Stand Size Class and Stocking Class	Region				Subtotal of Stocking Class
	Eastern	Northern	Southern	Western	
Nonstocked Stands					
Nonstocked & Poorly Stocked	21,207	36,703	3,856	-	61,766
Moderately Stocked	-	-	-	-	-
Fully Stocked & Overstocked	-	-	-	-	-
Subtotal of Nonstocked Stands	21,207	36,703	3,856	-	61,766
Small Diameter Stands					
Nonstocked & Poorly Stocked	56,204	118,646	34,346	25,209	234,405
Moderately Stocked	211,429	498,024	92,298	39,763	841,514
Fully Stocked & Overstocked	343,573	847,146	92,685	100,626	1,384,030
Subtotal of Small Diameter Stands	611,206	1,463,816	219,329	165,598	2,459,949
Medium Diameter Stands					
Nonstocked & Poorly Stocked	98,203	114,967	57,461	88,724	359,355
Moderately Stocked	2,486	19,019	5,236	10,553	37,294
Fully Stocked & Overstocked	10,872	2,365	3,580	-	16,817
Subtotal of Medium Diameter Stands	111,561	136,351	66,277	99,277	413,466
Large Diameter Stands					
Nonstocked & Poorly Stocked	23,712	55,488	20,902	-	100,102
Moderately Stocked	9,982	16,252	-	-	26,234
Fully Stocked & Overstocked	288	1,622	1,615	2,003	5,528
Subtotal of Large Diameter Stands	33,982	73,362	22,517	2,003	131,864
Ownership share of 0 - 49 sq. ft. basal area class	777,956	1,710,232	311,979	266,878	3,067,045

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NUMBER OF TREES

The USDA Forest Service recommends continued aggregation of some individual species into species groups when reporting data on number of trees and volume, in order to overcome the limitations of the small sample size.

For the purposes of this report, "species group" and their specific inclusive species are defined in the glossary of inventory terminology (p. 27):

For trees 5.0" dbh and larger, the combined data show:

- **The most abundant commercial tree species/species groups are (in descending order) spruces, balsam fir, sugar maple/beech/birch, and red maple.** (Appendix A. Table 13.)

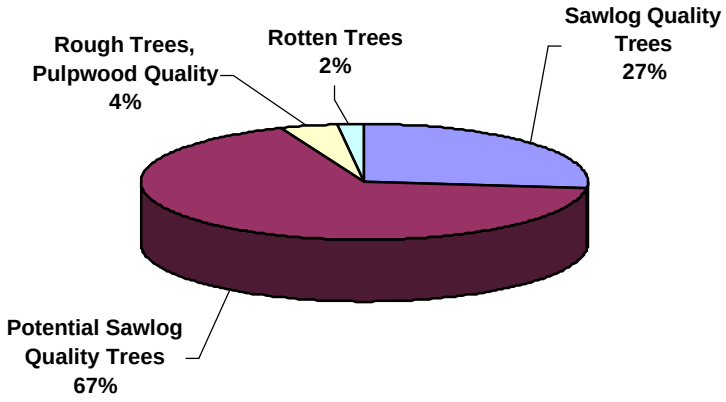
- **Since 1995, no significant differences occur in the number of growing stock trees in any species/species group or in any of the three diameter groupings** (Appendix A. Table 14.).

- **Tree Quality: 94% of live merchantable size softwood trees are either sawtimber or potential sawtimber trees. 85% of live merchantable size hardwood trees are either sawtimber or potential sawtimber trees** (Appendix A. Table 13. And Table 14. And Figure 2A. And 2B.).

  While these percentages are seemingly high, an examination of Figures 2A and 2B shows that only:
  - 1 out of every 2.5 softwood trees advances to the sawlog size and quality category, and that only
  - 1 out of every 5 hardwood trees advances to the sawlog quality and size category.

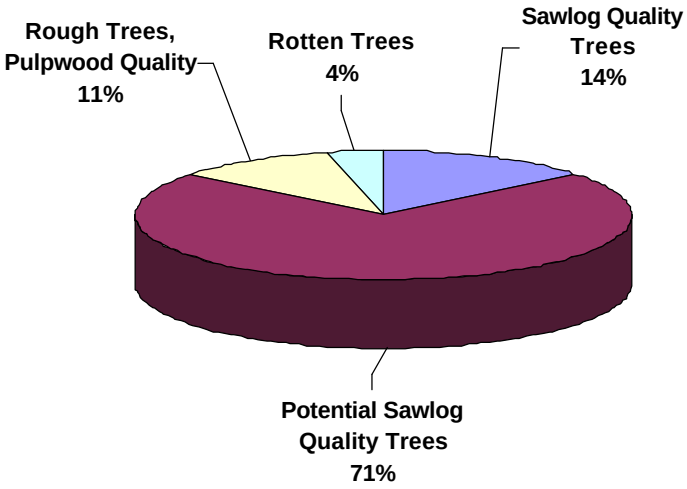
  This is a natural phenomenon that occurs over time. Increased competition for available space and limited resources leads to mortality and a decline in vigor for a high percentage of trees (a weeding out process).

Figure 2A. Distribution of live merchantable size (5.0" dbh and larger) softwood trees by Tree Class



- **Tree Quality: 98% of live merchantable size softwood trees (5.0" dbh and larger) are Pulpwood Quality or Better. 96% of live merchantable size hardwood trees are Pulpwood Quality or Better.** (Appendix A. Table 13. And Table 14. And Figure 2A. And 2B.)

Figure 2B. Distribution of live merchantable size (5.0" dbh and larger) Hardwood trees by Tree Class



For all live trees 1.0" dbh and larger, the combined inventory shows:

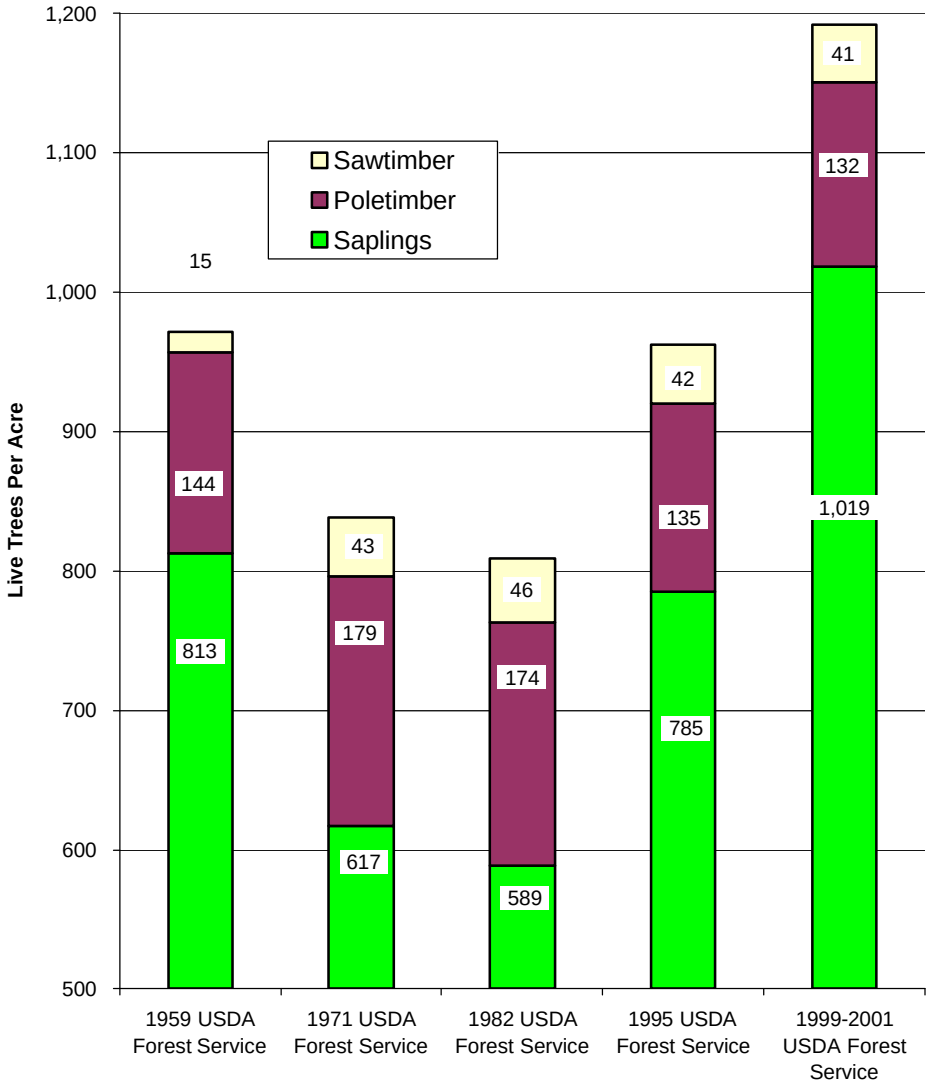
- **The most abundant commercial tree species/species groups are (in descending order) balsam fir, red maple, sugar maple/beech/birch, spruces, and intolerant hardwoods** (Appendix A. Table 16.).

- **The largest increases, since 1995, in the number of live trees are (in descending order) balsam fir, red maple, and spruces. Balsam fir has four times the increase of either the red maple and spruces species/species groups** (Appendix A. Table 16.).

- **Since 1995, the only species/species group to decrease in the number of live trees is other misc. commercial hardwoods** (Appendix A Table 16.).

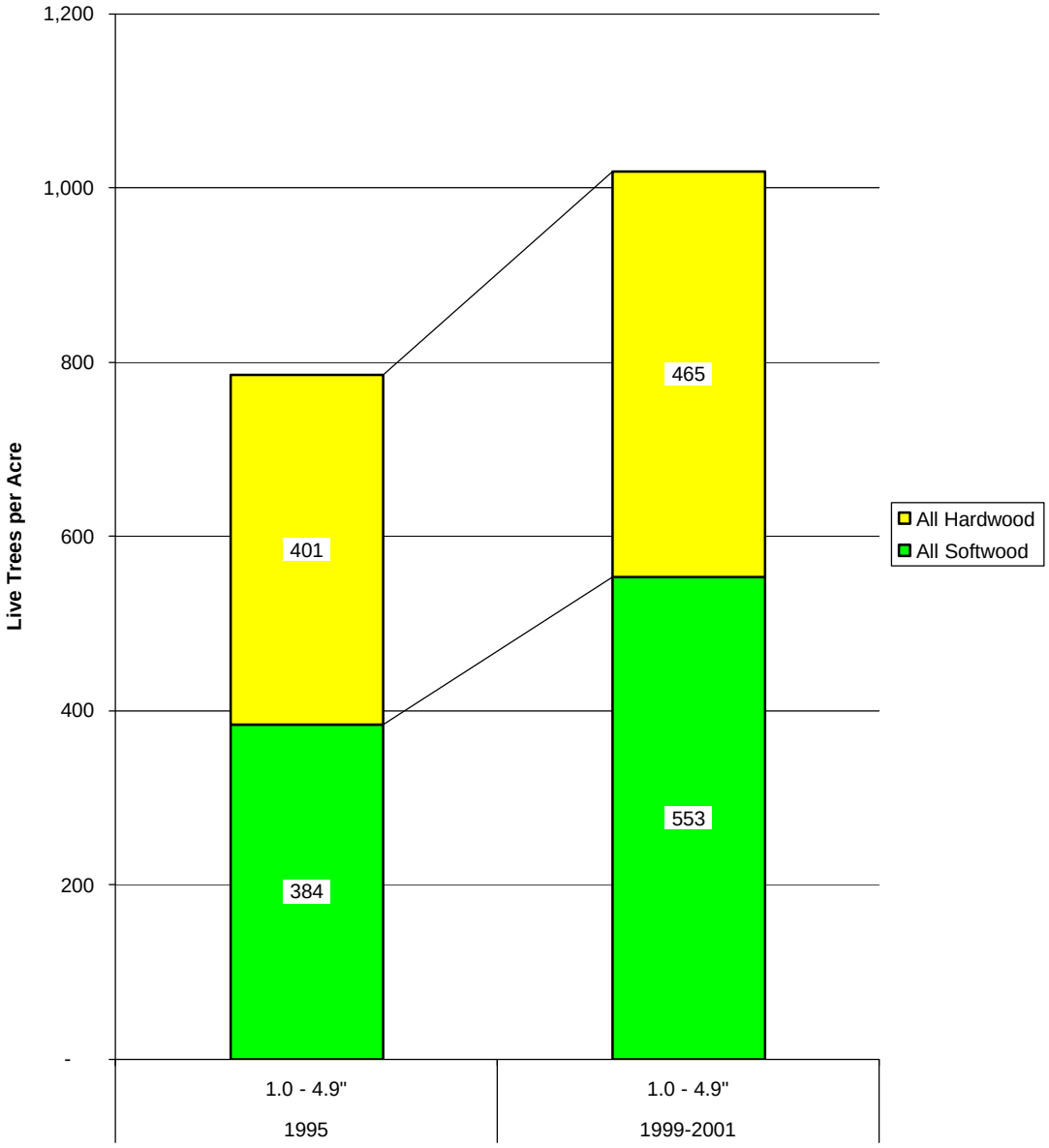
- **Since 1995, there is an estimated 47% increase in the number of all softwood trees and a 16% increase in the number of all hardwood trees. These changes occur primarily in the sapling diameter class (1.0" - 4.9" dbh), with an estimated 30% increase on a per acre basis** (Appendix A. Table 16. And Figure 3.).

Figure 3. Major Size Class Distribution of Live Trees per Timberland Acre
(Average Live Trees/Acre by DBH Grouping displayed)



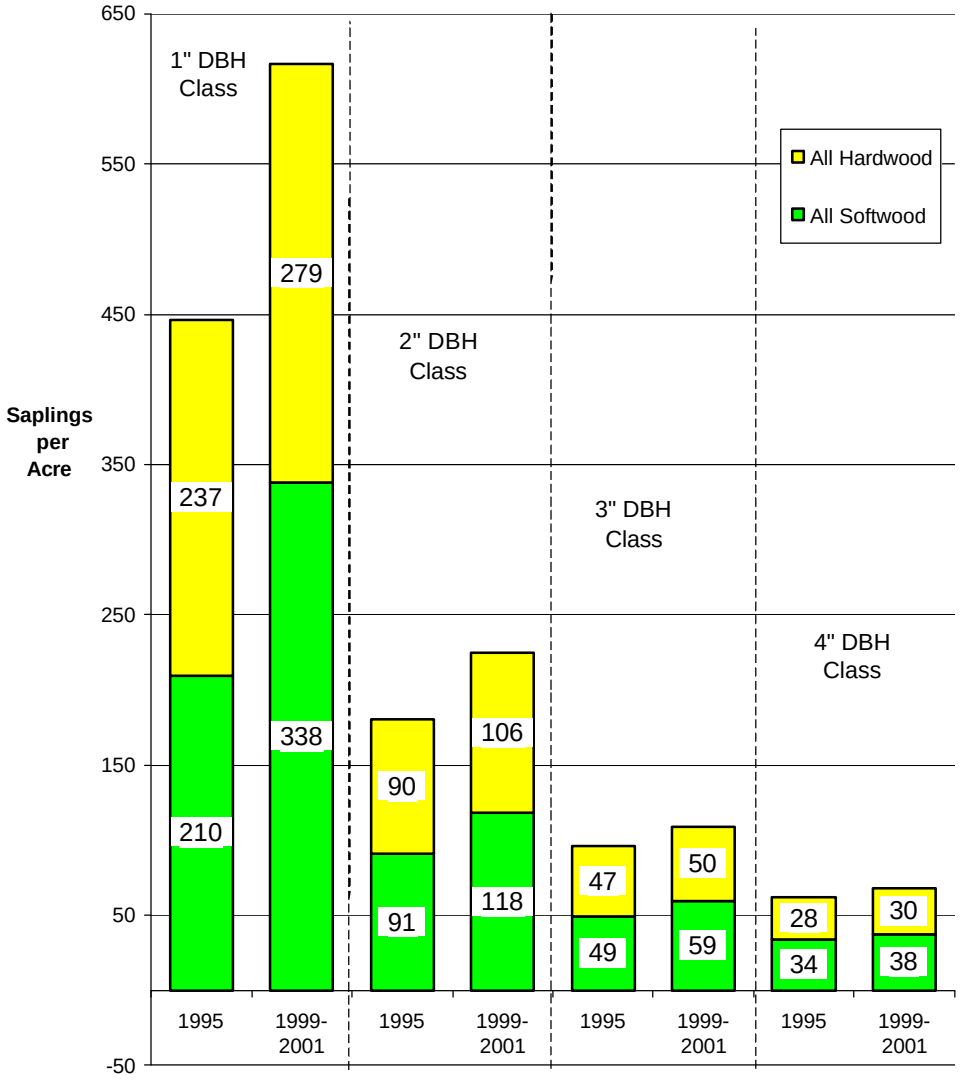
- **The dynamics occurring in saplings are primarily attributable to changes in the average per acre stocking of softwood species, representing 73% of the overall increase since 1995** (Figure 3. And Figure 4.).

Figure 4. Hardwood and Softwood Saplings per acre, comparison between 1995 and the 1999 - 2001 Inventory



- Examining individual dbh classes, most of the increased stocking occurs in the 1” dbh class (73%), followed by the 2” dbh class (19%).
- Within all four dbh classes, softwood species represent the majority of the increase (Figure 5.).

Figure 5. Change in Live Saplings per Acre, 1995 and 1999 - 2001, by Softwood/Hardwood Groupings and by DBH Class



- The USDA Forest Service provided a restatement of the 1995 periodic inventory sapling data, by 1" dbh classes, allowing MFS to statistically test the significance of the previously discussed descriptive observations regarding Figure 4 and Figure 5.

  The 1999 - 2001 data estimates significant increase in the total number of saplings occurring on all timberland acres in the 1'', 2", and 3" dbh classes, and a marginally significant increase in the 4" dbh class. These increases reaffirm the successful regeneration of Maine's forests following the recent spruce budworm outbreak and associated concerns about sustainable harvesting. Even more encouraging, this wave of increased sapling stocking currently extends into the 4" dbh class, foretelling of merchantable ingrowth in less than 10 years.

  In addition the following species/species groups experienced significant stocking increases in their sapling dbh classes: balsam fir (+56%), spruces (+42%), and red maple (+40%). Softwoods overall have a significant increase of 48% and hardwoods overall have a significant increase of 19% in stocking across the state (Table 16A.).

- A regional assessment of sapling-sized trees is provided in Tables 16-A1 through 16-A4, further delineating where the sapling increases are occurring.

  Estimates for the Eastern Region (Hancock, Penobscot, and Washington Counties) have significant sapling increases in the 1" and 2" dbh classes (+51% and +27% respectively) and in the species/species groups of balsam fir (+43%), red maple (+54%), All Softwood (+38%), and All Species (+36%) (Table 16-A1. Eastern Region).

  The estimates for the Northern Region (Aroostook, Piscataquis, and Somerset Counties) have significant increases in each of the 1" sapling dbh classes (+53%, +39%, +24%, and +24% respectively) and for the species/species groups of balsam fir (+77%), spruces (+57%), red maple (+54%), All Softwoods (+69%), and All Species (+45%) (Table 16-A2. Northern Region).

  Finally, none of the estimates for the Southern Region or the Western Region depict any significant differences in any of the sapling dbh classes or for species/species groups (Table 16-A3. Southern Region And Table 16-A4. Western Region).

VOLUME

- **The 1999 – 2001 estimate of growing stock volume is 22,574 million cubic feet, a significant increase from the 1995 estimate of 20,823 million cubic feet** (Appendix A. Table 19.).

- **Between 1995 and the combined 1999 – 2001 estimates there are no significant differences in the following volume estimates:**

  - **In growing stock volume for any species/species group, statewide or by region** (Appendix A. Tables 19. And 19A, B, C, and D)

  - **In any of the three diameter groupings, statewide or by region** (Appendix A. Tables 19. And 19A, B, C, and D)

  - **No significant differences in sawtimber volume (million board feet) for any species/species group or diameter class grouping** (Appendix A. Table 27.).

- **Significant increases do occur, between 1995 and the 1999 – 2001 estimates in** (Appendix A. Table 23.)**:**

  - **Volume of all live softwood trees: +11%**
  - **Volume of all live trees (Total - All Live): +10%**
  - **Volume of commercial tree species (Total – Commercial Trees): +9%**
  - **Volume of pulpwood quality (Total – Pulpwood Quality): +10%**
  - **Volume of growing stock (Total – Growing Stock): +8%**

- **Pulpwood Quality or Better trees average 16.0 cords/acre. This is a 1.0-cord/acre increase from the 1995 estimate. 70% of the gain occurs in softwood species** (Appendix C. Figure 1.).

- **The combined 1999 – 2001 inventory estimate of pulpwood quality trees or better is 23,710 million cubic feet (279 million cords). This is a significant increase (10%) in volume from the 1995 estimate of 21,597 million cubic feet (254 million cords). The chart in Appendix C. Figure 2., clearly depicts the impact of the still increasing sample size, from the original 646 plots in 1999 to the current 2,037 plots in 2001, on the width of the respective estimate's 95% confidence interval band (**Appendix A. Table 23. And Appendix C. Figure 2.).

GROWTH

The combined 3-year estimate using all 2,037 plots and their representative sample area of 339.5 acres provides a valid statistical snapshot of inventory estimates in 2001.

The available sample for growth estimates consists of just 41.75 acres. This is due to a combination of the low percentage of remeasured plots (approx. 50% of the entire sample) and the small plot area remeasured (only one of the 1/24-acre subplots). The combined impact is that only roughly 12% of the data collected to date is on remeasured trees. This small, diverse, and highly variable sample does not yet support estimation of the standard components of change for growing stock volume since the 1995 estimate.

As an alternative, MFS is presenting estimates of basal area change components based on available remeasured trees. Basal Area is a direct conversion of the dbh measurement to represent the square foot surface area of the bole at that point. It is a two-dimensional construct, i.e. all 6.0" dbh trees have identical basal area, compared to deriving the three dimensional estimation of a tree's volume. Tree volume is dependent upon the species, dbh measurement, estimation of merchantable bole length, and a cubic foot cull discount percentage for observed defects. It is rare that even two - 6.0" dbh spruce trees generate an identical merchantable volume, due to differences in bole length and cull defect. In order to meet legislative mandates and an expressed public interest in growth, basal area was chosen as the most available and stable change parameter to analyze and discuss.

The individual basal area growth components (Table 29: Average Annual Net Change of Growing Stock Basal Area on Timberland by Species/Species Group) present some interesting indications of past change and future trends.

- The annual estimate of balsam fir ingrowth at 3.54 million square feet is more than its accretion, indicating that a younger forest is starting to cross over the minimum merchantability limit of 5.0" DBH. This is the first time since the 1971 Periodic Inventory that any species has experienced more ingrowth than accretion. The ingrowth change component is the one to continue to scrutinize, as it will indicate when Maine's forest resources get revitalized with a wave of young and newly merchantable sized trees. Based on current indications and predictions this wave will cross over the merchantable limit within the next 5 – 10 years and provide a positive influence to inventory levels.

- The estimates of positive balsam fir net growth and positive Hemlock net change are major reversals from the 1995 change analysis.
- The annual total removal estimate of -29.34 million square feet, when roughly converted to volume, produces an estimate of 5.9 Million Cords, which compares very well to the reported average harvest of 6.1 Million Cords for the 5-year period of 1996 – 2000.
- The overall annual net change estimate of -14.81 million square feet is not surprising given the continued and predominant overmaturity of Maine's merchantable forest resources. The principal is still being drawn down, pending the emergence and measurement of merchantable young stands created in the 1970's – 1980's as a result of the spruce budworm epidemic and the resulting pre-salvage and salvage harvesting. The estimated net change can also be thought of as an average 1% annual withdrawal from the current basal area inventory.
- The growing stock decrement estimate is almost equal to estimated mortality. This situation is a combination of the general overmaturity, declining quality, and potential Ice Storm impacts to the current merchantable forest resources.

MFS is currently implementing a process to collect additional remeasured data from a subset of the plots measured in 1995, and still retained as part of the five annual panels. The approximately 500 plots in this separate study will provide an independent benchmark and check to the growth estimated by the annualized FIA system following the 2003 measurement season.

ADDITIONAL INFORMATION:

http://www.fs.fed.us/ne/fia/states/me/me.html

For the following links:

- Highlights of the 1995 Maine Inventory
- To view distribution maps of 14 important species
- To view/print a copy(s) of the tables from the 1995 statistical report

http://www.maineforestservice.org

Under the Current Publications bar, the following publications can be viewed and downloaded:

- Second Annual Inventory Report on Maine's Forests, Released September 6, 2001
- Charts from Second Annual Inventory Report on Maine's Forests
- Report of the 1999 Annual Inventory of Maine's Forests, Released October 24, 2000
- Charts from Report of the 1999 Annual Inventory of Maine's Forests

Glossary of Inventory Terminology

Accretion – The estimated net growth on surviving growing stock trees that were measured during the previous inventory (divided by the number of growing seasons between surveys to produce average annual accretion). Accretion does not include the growth on trees that were cut during the period, nor those trees that died. This component of change uses the incremental difference in the tree's basal area between the two inventories.

Basal Area – The cross-sectional area of a tree stem at breast height, expressed in square feet.

Board Foot – A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, and 1,000 Board Feet = 1 MBF.

Commercial Species – Tree species currently or prospectively suitable for industrial wood products; excludes species of typically small size, poor form, or inferior quality.

Diameter at Breast Height (dbh) – The diameter outside bark of a standing tree measured at 4 ½ feet above the ground.

Forestland – Land at least 10% stocked by forest trees of any size, or land that formerly had such a tree cover and is not currently developed for a non-forest use.

Gross Growth – The arithmetic sum of the Ingrowth and Accretion components of change.

Growing Stock Decrement – Includes growing stock trees in the previous inventory that are classified as rough or rotten in the current inventory (divided by the number of growing seasons between surveys to produce average annual growing stock decrement). This component of change uses the previous tree's basal area.

Growing Stock Increment – Includes either rough or rotten trees in the previous inventory that are classified as growing stock trees in the current inventory (divided by the number of growing seasons between surveys to produce average annual growing stock increment). This component of change uses the current tree's basal area.

Growing Stock Tree (or Growing Stock) – A classification of timber inventory that includes live trees of commercial species meeting specified standards of quality and vigor. Cull trees (rough and rotten trees) are excluded.

Growing Stock Volume – Net volume, in cubic feet, of growing stock trees 5.0 " dbh and larger from a 1-foot stump to a minimum 4.0" top diameter outside bark of the central stem, or to a point where the central stem breaks into limbs. Net volume equals gross volume discounted by cubic foot cull defect (%).

Harvest – Includes growing stock trees harvested or killed in logging, cultural operations (such as timber stand improvement) or land clearing on land that remains in timberland. This component of change uses the previous tree's basal area.

Ingrowth – Includes growing stock trees that became 5.0" dbh or larger during the period between inventories (divided by the number of growing seasons between surveys to produce average annual ingrowth). Also, includes growing stock trees, 5.0" dbh and larger, that are growing on land that was reclassified from noncommercial forestland or nonforest land to timberland. This component of change uses the current tree's basal area.

International ¼-inch rule – A log rule formula for estimating the board-foot volume of logs. The mathematical formula is:

$$(0.22D^2 - 0.71D)(0.904762)$$

for 4-foot sections, where D = diameter outside bark at the small end of the log section. This rule is used as the USDA Forest Service standard log rule in the Eastern United States.

Land Use Removal – Includes growing stock trees, 5.0" dbh and larger, that are on land that was reclassified from timberland to noncommercial forestland or to nonforest land during the period between surveys. This component of change uses the previous tree's basal area.

Mortality – Includes growing stock trees that die from natural causes before the current inventory (divided by the number of growing seasons between surveys to produce average annual mortality). This component of change uses the previous tree's basal area.

Net Change – The difference between the current and previous inventory estimates of growing stock (divided by the number of growing seasons between surveys to produce average annual net change). It is the arithmetic sum of Net Growth minus Removals.

Net Growth – The resultant change from natural causes in growing stock during the period between surveys (divided by the number of growing seasons between the surveys to produce average annual net growth). It is the arithmetic sum of

Gross Growth, minus Mortality, plus Growing Stock Increment, minus Growing Stock Decrement components of change.

Owner Class – A variable that classifies land into finer categories of ownership.

Forest Industry – Land owned by companies or individuals that operate wood-using plants.

Nonindustrial Private – Land owned by companies, non-governmental organizations, or individuals that do not operate wood-using plants.

Public – Land owned by federal, state, municipal, or county government.

Poletimber Tree – A tree that is at least 5.0" dbh, but smaller than sawtimber size trees.

Softwood Species: 5.0" – 8.9" dbh
Hardwood Species: 5.0" – 10.9" dbh

Potential Sawtimber (i.e. Sawlog Quality) Tree – A commercial tree species that is field coded as a growing stock tree but is below the minimum dbh for sawtimber (<9.0" for softwoods and <11.0" for hardwoods).

Pulpwood Quality Tree – A commercial tree species that is field coded as a growing stock tree or as a rough cull tree.

Total Removals – Represents the arithmetic sum of Harvest and Land Use Removal components of change.

Rough Cull Tree – A live tree with less than 1/3 of its gross board foot volume coming from logs that meet size, soundness, and grade requirements; and more than ½ of the board foot cull is due to sound defects such as sweep, crook, etc. Or a live poletimber tree that prospectively will have less than 1/3 of its gross board foot volume coming from logs that meet size, soundness, and grade requirements; and more than ½ of the prospective board foot cull is due to sound defects such as sweep, crook, etc.

Sapling Tree – A live tree with a 1.0" – 4.9" dbh.

Sawlog Top – The point on the bole of a sawtimber tree above which a sawlog cannot be produced. The minimum sawlog top is 7.0" diameter outside bark for softwoods and 9.0" diameter outside bark for hardwoods.

Sawtimber Tree (i.e. Sawlog Quality Tree) – Softwood trees that are at least 9.0" dbh **or** hardwood trees that are least 11.0" dbh, that contain at least 1 – 12 foot log **or** 2 – noncontiguous 8 foot logs, that meet minimum sawlog grade specifications. In addition, the tree must have 1/3 or more of its gross board foot volume as merchantable material.

Sawtimber Volume – Net volume, in board feet, by the International ¼-inch rule, of sawlogs in sawtimber trees. Net volume equals gross volume discounted by board foot cull defect (%), which accounts for deductions for rot, sweep, and other defects that affect the use of lumber.

Species Group – as used in the Appendix A. Tables and in the annual report, species groups include the following species:

Group
Balsam Fir – balsam fir
Spruces – white spruce, red spruce, and black spruce
Eastern White Pine – eastern white pine
Northern White Cedar – northern white cedar
Hemlock – eastern hemlock
Other Miscellaneous Softwoods – these merchantable sized (5.0" dbh and larger) species were tallied in 1999, 2000, or 2001: plantation larch, tamarack, norway spruce, jack pine, red pine, pitch pine, pond pine, scotch pine
Red Maple – red maple
Sugar Maple/Beech/Birch – sugar maple, american beech, and yellow birch
Intolerant Hardwoods – paper birch, cottonwood species, balsam poplar, eastern cottonwood, bigtooth aspen, quaking aspen
Other Miscellaneous Commercial Hardwoods – these merchantable sized (5.0" dbh and larger) species were tallied in 1999, 2000, or 2001: silver maple, norway maple, ohio buckeye, sweet birch, shagbark hickory, white ash, black ash, green ash, butternut, black cherry, white oak, scarlet oak, northern red oak, black oak, black willow, basswood species, american basswood, elm species, american elm
Noncommercial Hardwoods – these merchantable sized (5.0" dbh and larger) species were tallied in 1999, 2000, or 2001: maple species, striped maple, mountain maple, serviceberry, gray birch, american hornbeam, apple species, eastern hophornbeam, pin cherry, chokecherry, willow species, american mountain-ash
All Unknown Species – Tree Species-Unknown/Not Listed

Stand Size – A stand descriptor that indicates which size-class of trees constitutes the plurality of stocking in the stand. This variable is field assigned, and then is also calculated as part of the USDA Forest Service validation process. The calculated value is used to assign stand size classes in this report.

Large Diameter Stand Size Class is comprised of:

- ≥ 10% stocking of trees of any size,
- > 50% stocking of trees with diameters ≥ 5.0" dbh, and
- Stocking of large diameter trees exceeds the stocking of medium diameter trees.

Medium Diameter Stand Size Class is comprised of:

- ≥ 10% stocking of trees of any size,
- > 50% stocking of trees with diameters ≥ 5.0" dbh, and
- Stocking of medium diameter trees exceeds the stocking of large diameter tree.

Small Diameter Stand Size Class is comprised of:

- ≥ 10% stocking of trees of any size, and
- > 50% stocking of trees with diameters < 5.0" dbh.

Nonstocked Stand Size Class is comprised of:

- < 10% stocking of trees of any size

Small Diameter Trees – Trees with a dbh range of 1.0" – 4.9"

Medium Diameter Trees – For softwood species, this is a tree with a dbh range of 5.0" – 8.9". For hardwood species, this is a tree with a dbh range of 5.0" – 10.9".

Large Diameter Trees – For softwood species, this is a tree with a 9.0" dbh and larger. For hardwood species, this is a tree with an 11.0" dbh and larger.

Stocking – The relative degree of occupancy of land by trees, measured as basal area or the number of trees in a stand, by size, age, or spacing; as compared to the basal area or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

This variable is field assigned. In the USDA Forest Service data validation process, a national algorithm is used to calculate this variable. The calculated variable is used in this report.

The 5 stocking classes are:

Nonstocked	< 10% stocking
Poorly Stocked	≥ 10% Stocking and < 35% Stocking
Moderately Stocked	≥ 35% Stocking and < 60% Stocking
Fully Stocked	≥ 60% Stocking and < 100% Stocking
Overstocked	> 100% Stocking

Timberland – Forest that is producing or capable of producing crops of industrial wood and is not withdrawn from timber utilization by statute (Acadia National Park, Appalachian Trail Corridor) or administrative designation (Baxter State Park, Bureau of Parks & Lands Ecological Reserves) (Land withdrawn from timber utilization must be publicly owned land).

Areas qualifying as timberland have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas are small

and unlikely to become suitable for the production of industrial wood in the foreseeable future.

Timberland may be nonstocked provided that neither any natural condition, nor any activity by humans, prevents or inhibits the establishment of tree seedlings.

Rural – Defines a subset of forestland, which is now grouped into Timberland. This category represents the historical and traditional acreages classified as Timberland in previous inventories, and has the identical definition.

Other Forestland – Defines a subset of forestland, which is now grouped into Timberland. It is producing, or capable of producing, crops of industrial wood, but is associated with, or part of a nonforest land use. In the past, these areas would have been treated as inclusions in the nonforest land use because they were considered part of a development. The minimum area for classification as Other Forestland is one acre and these strips of timber must have a crown width at least 120 feet wide. Some examples of land that could be classified as Other Forestland are forested portions of city parks, forested land in highway medians and rights-of-way, forested areas between ski runs, and forested areas within golf courses. *Generally, although surrounded by nonforest development, these areas have not been developed themselves, and exhibit natural, undisturbed understories.*

Urban Forestland – Defines a subset of forestland, which is now grouped into Timberland. Land that except for its location would ordinarily be classified as timberland. This land is either nearly (surrounded on three sides), or completely, surrounded by urban development, whether commercial, industrial, or residential. This land meets all the criteria for timberland, that is, at least one acre; capable of producing at least 20 cubic feet per acre per year of industrial wood; is not developed for some use other than timber production; and is not reserved by a public agency. It is extremely unlikely that such land would be used for timber products on a continuing basis. Such land may be held for future development, or scheduled for development. (The timber that is present may be utilized only at the time of development.) The land may be undeveloped due to periodic flooding, low wet sites, steep slopes, or their proximity to industrial facilities that are unfavorable to residential development. *Forested areas within city parks are not urban forestland; it may be Other Forestland, if the requirements are met. City Parks cannot be classified as Urban Forestland as it is currently defined.*

APPENDICES

NOTE:

a) All tables in this report may not add to the row, column, or table totals due to rounding.

b) All estimates in this report are derived from ground plots, except where noted.